Utilizing material from old nests – a way to time-saving in species with a short breeding season? The case of the Long-tailed Tit *Aegithalos caudatus*

Grzegorz Hebda

Laboratory of Vertebrate Zoology, Department of Biosystematics, University of Opole,
Oleska 22, 45-052 Opole, Poland
grzesio(at)uni.opole.pl

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> Abstract

The Long-tailed Tit (*Aegithalos caudatus*) is a species characterized by high levels of nest depredation and a short breeding season. In the face of such high levels of nesting failures, behavioural adaptations to reduce failures should be expected. Here I report on two cases where Long-tailed Tits appeared to reduce their re-nesting interval by utilizing material from destroyed nests to build new ones. I suggest that using a previous nest to build a subsequent nest is an adaptation in Long-tailed Tits aimed at increasing the speed with which a pair can begin to re-nest and hence increasing their breeding success in a given year.

> Kurzfassung

Die Schwanzmeise (*Aegithalos caudatus*) zeichnet sich durch einen hohen Grad an Nestplünderungen während einer verhältnismäßig kurzen Brutsaison aus. Angesichtes solch hoher Brutverluste sollte man Verhaltensanpassungen zur Verminderung solcher Verluste erwarten. Hier wird von zwei Fällen berichtet, in denen Schwanzmeisen das Intervall zwischen Erst- und Ersatzbrut dadurch verkürzten, indem sie Nistmaterial aus zerstörten Gelegen für den Bau neuer Nester benutzen. Vermutlich ist die Verwendung eines geplünderten Erstnestes für den Bau eines Zweitnestes eine Anpassung der Schwanzmeisen, um eine schnellere Folge- oder Ersatzbrut und damit einen erhöhten Bruterfolg zu erzielen.

> Key words

Breeding biology, open nest, nest-depredation rate, behavioural adaptation, Poland.

Introduction

Building a nest constitutes a large reproductive investment for Long-tailed Tits (*Aegithalos caudatus*). This stage can last up to 25 days, although it typically takes less time as the season progresses, in part, because due to warmer and dryer climate in the late season requirements of nest insulation are lowered (Hatchwell *et al*., 1999a). The cost of nest construction for breeding pairs is considerable. They use, among others, a few thousand pieces of lichens and about 1500-2000 feathers (Gaston, 1973; Hansell, 1995, 2000; Hatchwell *et al*., 1999a). The Long-tailed Tit builds nests in very diverse sites in terms of: height above the ground (1-30m), vegetation type (shrubs, bushes and trees) and position (twigs, tree trunk and fork, pine fronds) (Lack & Lack, 1958; Gaston, 1973; Nakamura, 1976; Hansell, 1995, 2000; Hatchwell *et al*., 1999b, Wesołowski & Czuchra, 2000). One of the most important limiting factors, at least in some habitats, seems to be the abundance of feathers for nest lining and lichens for camouflage (Møller, 1984; Hansell & Ruxton, 2002; Tomiałojć & Stawarczyk, 2003). Despite their flexibility in nest site location and position, and despite their considerable camouflage (lichens), nest depredation rates are commonly as high as 80%. Nest depredation is largely caused by corvids and mustelids (Lack & Lack, 1958; Gaston, 1973; Nakamura, 1976; Hatchwell *et al*., 1999b; Wesołowski & Czuchra, 2000). The success of Long-tailed Tits is therefore dependent on multiple attempts per season, and this in turn is dependent on the speed of re-nesting following a failure. Here, I report two cases in which Long-tailed Tits dramatically changed

their nesting sites utilizing material from destroyed nests to build new ones and propose an explanation of such behaviour.

A study on Long-tailed Tits was conducted in oak–hornbeam forest in the Odra River valley in the Opole Province (SW Poland). Observations were made within two compact forest complexes: 215 and 260 ha. The dominant vegetation type there was oak-hornbeam stand *Galio sylvatici-Carpinetum*, with domination of oak *Quercus* spp. and hornbeam *Carpinus betulus*. Less common was *Ficario-Ulmetum campestris*, which only occasionally constitutes a compact wood. Small stretches of old riverbeds were situated in both forest complexes. Forests were surrounded by farmland and meadows. Tree age was very diverse, but large parts of the study sites were covered by stands more than 100 years old. In 2003, when detailed data on density of breeding pairs were obtained, the total density was 0.4-0.6 pairs/10 ha on plot I and 0.9-1.0 pair/10 ha on plot II. Birds were captured, ringed and photographed to facilitate identification of every bird.

Results

Case 1.

On 15 of March 2001 at 8.30 a.m. one of the birds from a breeding pair of *Aegithalos caudatus caudatus*, which had started to build its nest on 15 of February, flew to its unfinished nest and diminished it. With material from its old nest in its beak it began to construct a new one. The old nest was established in a 125 year-old oak-hornbeam stand, 52 m from its edge. It was positioned in a branch fork in a 20 m high live oak at a height of 15.5 m above the ground. The new nest was positioned in reeds *Phragmitatis australis*, 5 m from the forest edge, about 70 m from the old nest. It was placed at a height of 1.35 m above the ground, squeezed between the vertical stems of the reeds and supported from one side by twigs of blackthorn *Prunus racemosa*. The height of the reed vegetation did not exceed 2 m. On 15 of March only the foundations of the new nest were complete. During the next observation, on 11 of April, the female was incubating 11 eggs. Further checks were not conducted.

Case 2.

On 3 of April 2003 at 10.30 a.m. a pair of Long-tailed Tits (one bird *A. c. caudatus* and one *A. c. europaeus*) diminished its previously depredated nest and started building a new one at a distance of about 50 m. The old nest was located in a 130 year-old oak-hornbeam stand, 21 m from its edge. It was placed in a 25 m live oak, squeezed behind displaced bark of a dead, vertical hanging branch 13 m above the ground. The new nest was placed behind displaced bark of a spruce log from a hunters' hide, which was located right on the forest edge bordered by farmland. The new nest was placed at a height of 0.5 m above the ground. On 3 of April the birds were lining the new nest with feathers and only this kind of material was collected from the old one.

Discussion

The Long-tailed Tit is characterized by a relatively short breeding season and an extremely high level of nest-depredation, reaching as high as 95% (LACK & LACK, 1958; BOGUCKI, 1959; RIEHM, 1970; GASTON, 1973; NAKAMURA, 1976; HATCHWELL *et al.,* 1999b, WESOŁOWSKI & CZUCHRA, 2000). In the face of such a high level of nesting failures, behavioural adaptations to reduce failures and thus increase breeding success should be expected. One way in which failed breeders in Long-tailed Tits can increase their breeding success is by helping to rear the young of relatives which share some proportion of the same genes. Studies of Long-tailed Tits in the UK show that individuals that fail late in the season direct their care towards chicks of a nearby relative (RUSSELL & HATCHWELL, 2001) and that pairs failing late in the season gain greater reproductive benefits from helping kin than by attempting to re-breed (MACCOLL & HATCHWELL, 2002, 2004). However, earlier in the season, individuals that breed successfully have a clear advantage against those that fail and become helpers (HATCHWELL *et al.,* 2004). Consequently, the fact still remains, that selection should have acted on Long-tailed Tits in order to reduce breeding failures.

Here, I have described two cases of Long-tailed Tits utilizing material from their old nest to build their new one. The two described cases were observed during the time when the majority of Long-tailed Tits has already started to lay eggs in Poland (WESOŁOWSKI & CZUCHRA, 2000; own data), and when cooperative breeding is rare (HATCHWELL *et al.*, 1999a). Although I report on just two cases here, it has also been observed elsewhere in Poland (P. ROWIŃSKI pers. comm.) and it is apparently not uncommon in at least two sites in the UK (B.J HATCHWELL & A.F RUSSELL pers. comm). Using the material from a previous unsuccessful nest to build a subsequent nest may arise for two reasons in a species with high nest failure rates and short breeding periods. First, it could arise if nesting material is rare. I believe that this is unlikely to explain the behaviour observed, because both observations cited above and a third from the Bialowieza Primeval Forest

(P. Rowiński – unpbl.) took place in habitats in which important materials, such as lichens were abundant. In addition, experimental studies (Hansell, 1995; Hansell & Ruxton, 2002) showed that Long-tailed Tits can easily find enough feathers to line their nests, utilizing dead birds or their remains. Although feather availability, as well as competition for these, can be locally variable and dependent on habitat structure and diversity of bird communities (Hansell & Ruxton, 2002), the substantially lower breeding density of Long-tailed Tits in Poland compared with the UK suggests that competition for feathers is likely to be very low. A second and I believe more likely reason is that Long-tailed Tits are under extreme temporal constraints to re-nest quickly. Fast re-nesting does not only mean that more nesting attempts can be made per season, increasing the chance that one will succeed, but also goes along with a higher probability of an early fledging and thus a higher survival rate of chicks to the following year (MacColl & Hatchwell, 2002, 2004). I therefore suggest that using a previous nest to build a subsequent one is an adaptation in Long-tailed Tits aimed at an increase of the speed with which a pair can begin to re-nest and hence of breeding success in a given year.

However, the re-nesting behaviour described here also lends weight to the idea that Long-tailed Tits reduce the chance of nest failure by radically changing the position of the following nest (see also Lack & Lack, 1958; Riehm, 1970; Hatchwell *et al.,* 1999b). For example, the second nest was not only positioned tens of metres from the first, but changed dramatically in height and location; with similar results having been found previously (Hatchwell *et al.,* 1999b). Such behaviour, which may be influenced by individual experience (Marzluff, 1988), makes searching for an active nest more difficult for a predator (Riehm, 1970).
The time of nest construction, when birds seek an appropriate quality and quantity of nest material over a large area is significant for breeding pairs of Long-tailed Tits (Gaston, 1973; Hansell, 1995; Hatchwell *et al.,* 1999b; Hansell & Ruxton, 2002). Because of frequent activity around a nest, birds can be predated or inform predators about their place of breeding. Finding a place profuse in nest material close to the breeding site could be very profitable, considerably shortening the time devoted for its location. The best strategy for a species with a short breeding period may be to use material from their previous nest to build their subsequent nest. In addition, dramatically changing the location of the subsequent nest may also reduce predation probability considerably, by reducing the search image of the predator. Here I suggest that such behaviours are adaptations to high rates of nest predation and short breeding periods, but experiments in which re-nesting intervals are measured when access to old nests is allowed or denied, are needed to test these suggestions empirically.

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